

to measure temperature, detect an arc fault or detect a degrading or failing device would be beneficial.

[0013] Another concern today is energy conservation which relates to power consumption. Smart meters utilized by utility companies, although reporting in real time, only provide consumption information for an entire account, and not at the device level. A failing or overloaded device for example may consume more power than it should or more power than it historically has. An example of monitoring energy consumption at the device level is to monitor consumption at a receptacle. One advantage of this is the ability to measure the power being consumed by a failing device. It would be advantageous to provide a system for monitoring energy consumption at a receptacle.

[0014] Still another concern is the quality of power in the system. Poor power quality can be traced back to the electrical utility company or by interference from a device. In either case, these power disturbances resulting in poor power quality may cause device failure or damage to sensitive electrical devices.

[0015] Thus, it is desirable to provide an intelligent switchable device that can produce a signal indicative of the condition of a branch circuit, monitors and reports power consumption at the receptacle, detects arc faults and electrical problems as well as power disturbances. Additionally, it is also desirable to provide a receptacle that is normally open until a plug is engaged into the load side. Finally, it is also desirable to provide a receptacle that can communicate the device's state to external devices.

SUMMARY

[0016] An intelligent switchable device for selectively conducting electricity comprises a switch for connecting a power line to a load, where the switch has a control input. The intelligent switchable device has at least one sensor for producing a sensor signal indicative of a condition and a transceiver for transmitting data, including communications and receiving data, including remote instructions and rules. Non-volatile memory is adapted for storing (i) a program having instructions and (ii) rules for determining whether to render said switch conductive or non-conductive.

[0017] A control circuit is in communication with the transceiver, the sensor and the switch, where the control circuit produces a command signal in response to a sensor signal as determined by the rules. The control circuit has a first mode of operation when the control circuit issues a command signal to render said switch in a conductive state and a second mode of operation when the control circuit issues a command signal to render said switch in a non-conductive state and a third mode of operation where the rules command the switch to be non-conductive.

[0018] The intelligent switchable device further comprises a control circuit that comprises a fourth mode of operation where the control circuit issues a command signal to render said switch in a non-conductive state based on a remote command. The device may determine the condition of a power line, such as a branch circuit or the condition of a load.

[0019] The transceiver is able to transmit communications indicative of a condition to a remote device, such as a monitor or a server.

[0020] A vector network analyzer circuit operatively coupled to said control circuit, wherein said control circuit

commands said vector network analyzer circuit to issue a test signal to a branch network.

[0021] Further objects, features and advantages of the disclosed embodiments will become apparent to those skilled in the art from analysis of the following written description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. 1 is a prior art environmental illustration of an electrical receptacle shown connected to a common electrical power line and breaker box with a detail of the wires that comprise a power line;

[0023] FIG. 2 is a prior art environmental illustration of an electrical receptacle shown connected to the wires of a common electrical power line of FIG. 1;

[0024] FIG. 3A is an exemplary embodiment of a reporting device;

[0025] FIG. 3B is a partially exploded view of the reporting device of FIG. 3A, revealing a circuit board;

[0026] FIG. 4 is a sectional view of the reporting device of FIG. 3B, further revealing protected hot and neutral bus bars;

[0027] FIG. 5 is a schematic illustration of an exemplary protection circuit, comprising a switch having a control input to render a switch conductive or non-conductive;

[0028] FIG. 6 is a schematic illustration of exemplary temperature measurement module for detecting temperature of each of a hot and neutral bus line;

[0029] FIG. 7 is a schematic illustration of exemplary power measurement module for sensing power and current for each of a hot and neutral line;

[0030] FIG. 8A is a sectional view of the reporting device of FIG. 3B, revealing an embodiment of a prong detector;

[0031] FIG. 8B is a diagram of one embodiment of a prong detector;

[0032] FIG. 8C is a schematic representation of a pair of prong detectors of FIG. 8B, revealing the operative elements therein;

[0033] FIG. 8D is a schematic representation of a pair of filters for filtering out ambient light from the detectors of FIG. 8C;

[0034] FIG. 9 is a schematic illustration of a microcontroller;

[0035] FIG. 10 is a schematic illustration of multiple reporting devices in communication with a monitoring device;

[0036] FIG. 11 is a schematic illustration of multiple monitors in communication with a server;

[0037] FIG. 12 is an exemplary data flow chart.

[0038] FIG. 13 is an embodiment of a line monitoring circuit for determining whether the line is in use;

[0039] FIG. 14 is a test generation circuit producing a test signal to be injected into a line and issuing test commands;

[0040] FIG. 15 is a test switch circuit for directing a test and a response signal to a desired line; and

[0041] FIG. 16 is a line interface circuit for breaking a line connection.

[0042] For the purposes of promoting an understanding of the principles of the embodiments, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the embodiments is thereby intended. Any alterations and